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AN EXPERIMENT IN DRY LAND ORCHARDING

By Bernard Mackensen, M. S.



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An Experiment in Dry-Land Orcharding

By BERNARD MACKENSEN, M. S.

It was eleven years ago that the writer proceeded to put to the test his ideas regarding the growing of fruit-trees in a dry climate, such as that of Southwest Texas. His method, which he believes to be original with himself to a certain degree, does not employ ordinary irrigation but has recourse to what might be called storm-water irrigation without a reservoir, or conservation of the surface runoff.

LOCATION OF ORCHARD.

The plat (about 100x200 feet) selected for the experiment is situated in a slight depression on the eastern slope of a high hill (Beacon Hill) in the northern suburbs of San Antonio. The soil is what is designated in the Soil Survey of the San Antonio Area as the Houston black clay loam. It is grayish black to black and from two to five feet deep, being underlaid by marl, and this in turn by limestone. Plate XII. shows the character of the native vegetation (xerophytic) that was cleared from the land.

PREPARATION OF LAND.

In preparing the land, it was leveled in the north and south direction and ditches, broadly V-shaped in cross-section, were run across the plat in the same direction in such positions that they would lie midway between the rows of trees when these were planted. These ditches were connected with a broad and shallow main ditch running down the hill along the south side of the plat. The

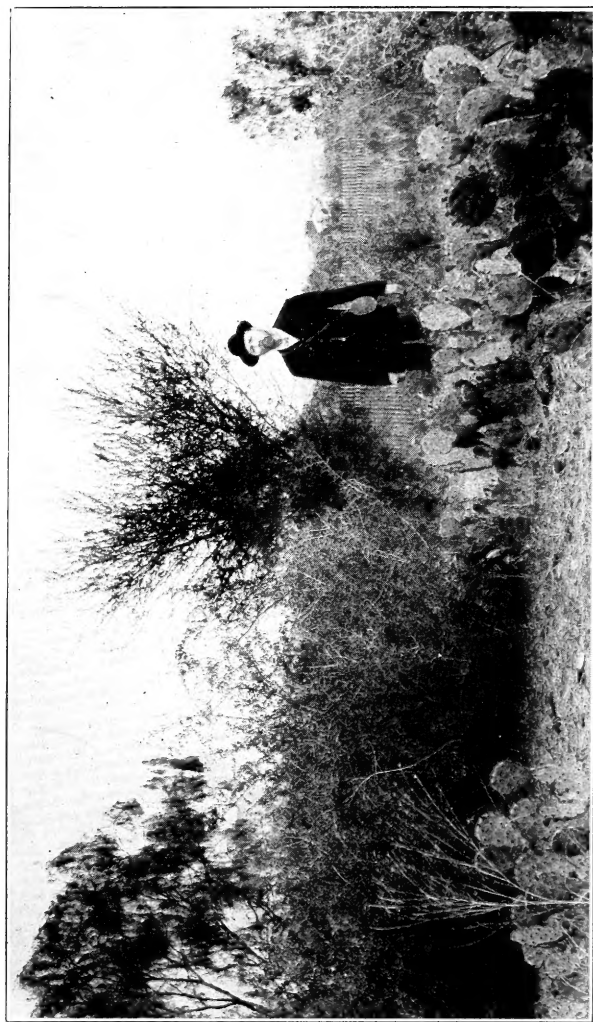
effect of this arrangement of ditches is, that when there is a sufficiently heavy rain, water runs down the hill into the main ditch, and from this into the laterals, as it arrives at them, these being deeper than the main. When all the laterals are nearly full, the excess of water runs off through the main without doing any damage, this ditch being well sodded with the native buffalo-grass, or curly mesquite (*Buchloe dactyloides*). The water held in the laterals penetrates deeply into the ground. Thus, in some cases, the trees are thoroughly watered when the adjoining land is moistened but a few inches deep. By maintaining a dust-mulch, much of this moisture is conserved, even during a long drought. There seems to be but little danger from excess of water, as the effect of such a condition was noticed but once in the history of the orchard, when one tree was lost from this cause.

HISTORY OF THE ORCHARD.

The land was planted to fruit-trees, fifty-five in number, partly in December, 1902, and partly one year later. These trees represented 21 varieties of peaches, 7 of plums, 5 of pears, and 2 of apples. The land was broken up deeply and the trees planted in holes four feet in diameter and over two feet deep. Each year during the period extending from March to October the orchard has been given from four to eight shallow cultivations by plowing, harrowing, hoeing, etc. In this way the weeds have been kept down, and the dust-mulch restored after each heavy rain.

The years 1903 to 1908 inclusive were favorable as to rainfall, the total for but one of these falling below the average annual precipitation (27 inches) of San Antonio. There were several comparatively short droughts, but the trees did not suffer seriously in consequence. Tests made during the droughts indicate that at no time did the per cent of moisture in the soil, calculated on the basis of the moist soil, fall below 16. This was at the depth of 8 inches. Tests of the soil at 18 inches showed a somewhat

Plate XII.



Native vegetation formerly on site of B. Mackensen's orchard—
mesquite, huisache, granjeno, brasil, prickly pear, etc.

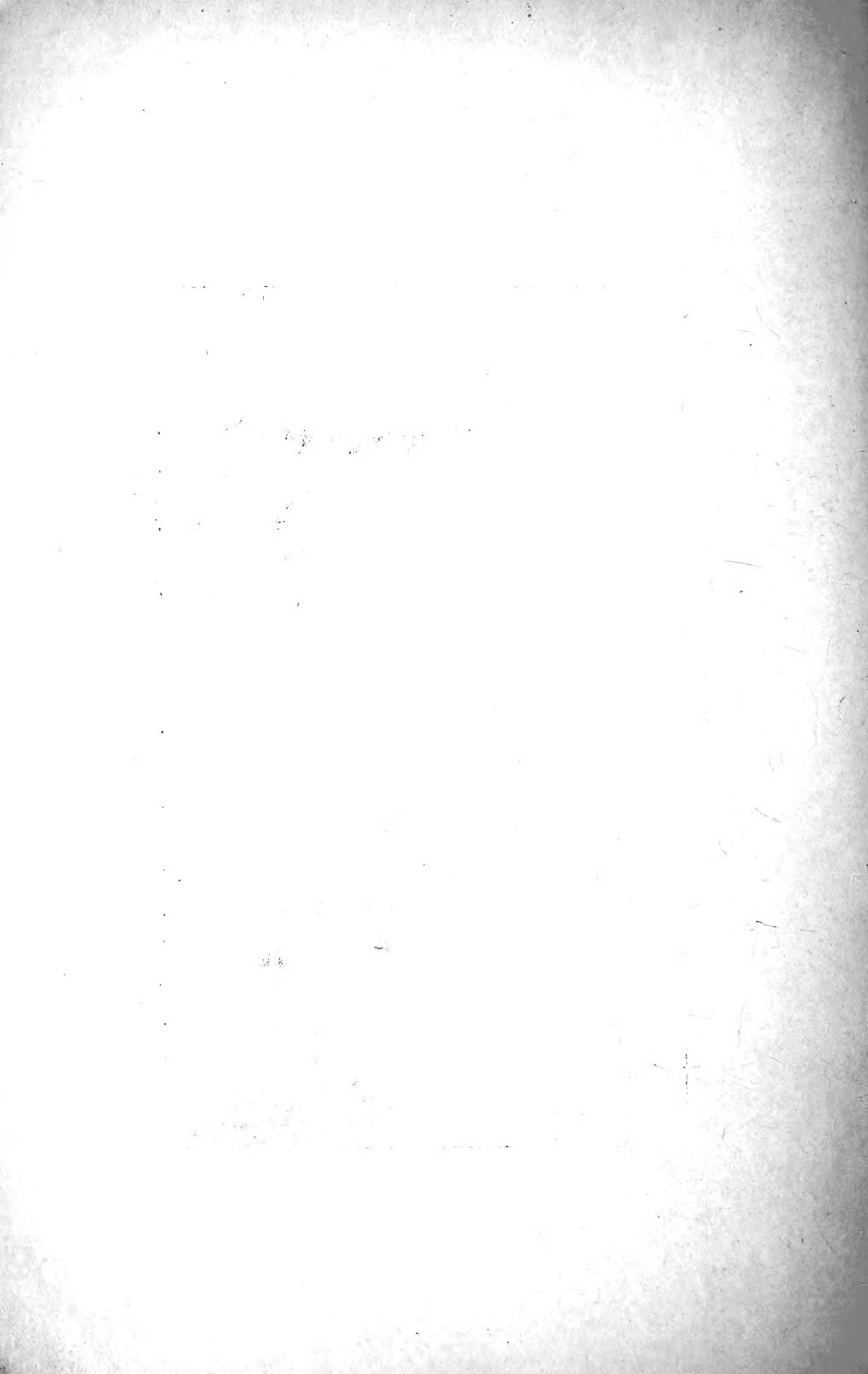




Plate XIII.

Fig. 1.—Orchard of B. Mackensen in June, 1903.



Plate XIII.

Fig. 2.—Orchard of B. Mackensen in September, 1911, after a rainless summer and at the end of three years of extreme drought.

greater per cent. Tests in the uncultivated ground adjoining the plat showed that this contained but one-half to two-thirds as much moisture as the cultivated land.

The trees suffered some damage from frosts following protracted warm weather in winter and early spring. Partly to this cause, too, must be ascribed the scanty production of fruit, especially of peaches. The severest ordeal, however, through which the orchard passed during these years was a terrific hail-storm (about June 1, 1907), which not only stripped the trees of their fruit and many of their twigs, but also deprived them of no small part of their bark. Fig 1, Plate XIII. shows the orchard near the close of this period.

The next three years (1909, 1910, and 1911) furnished a crucial test for the writer's method of maintaining an orchard during a drought. The total precipitation for these years was 14.92, 16.22, and 18.68 inches, respectively, showing this to be the severest period of drought recorded at San Antonio since the establishment of the U. S. Weather Bureau in 1885. The first of these years is notable for the lowest annual precipitation recorded by the Bureau. Despite this fact the moisture content of the soil in the orchard (at the depth of 8 inches) fell to only about 13 per cent during the most unfavorable part of the year, and the trees apparently suffered but little. The summer and early fall of 1910 proved to be a period of extreme drought, and the per cent of soil moisture fell as low as 9 at a depth of 8 inches. The trees in the upper part of the orchard withstood the two-year drought fairly well, while some of the peach and plum trees in the lower part, where the soil is shallow, suffered severely or died. But the climax had not yet been reached. During 1911 there was a practically rainless period extending from May 12th to October 30th. Toward the close of this period the soil at the depth of 8 inches appeared quite dry, but 10 per cent of moisture was still present at 18 inches. The appearance of the upper two rows of trees at this time is shown in Fig 2, Plate XIII. A number of peach and plum

trees succumbed during this trying period. The drought was broken by several rains toward the close of the year.

The year 1912 opened with conditions favorable for the orchard, the winter being uniformly cold and good rains falling in late winter and in the spring. The peach crop, for the first time in the history of the orchard, was ample. Many of the trees, despite the drought of the three preceding years, bore as much fruit as a tree should attempt to mature. The rainfall for the year (23.73 inches) was favorably distributed but still below normal. Several more of the peach-trees died during the year, which however was to be expected in an orchard nine or ten years old.

The year 1913 opened with further calamities for the orchard, the elements being apparently determined on its ruin. On February 26th another hail-storm, nearly as destructive as the first, visited the orchard, and this was followed on March 25th by a heavy frost. The rainfall was rather favorable till autumn, when it became excessive. The total for the year was 37.68 inches.

PRESENT CONDITION OF THE ORCHARD.

A short account of the present condition of the orchard, now 10 to 11 years old, should be instructive. Only 24 of the 55 original trees are still alive, and many of these are in a decrepit condition. The eleven plum-trees originally planted are all dead, the last having succumbed in 1911. This result is not so unfavorable when one considers that the species is short-lived by nature. Twenty of the original 34 peach-trees are still alive, but only five are in good condition. The remainder are declining, as shown by the presence of dead branches, sun-scald, etc. Eight pear-trees were included in the original planting. Four of these, which stood where the soil was shallow, did not thrive and were dug up after a few years, another died of disease, and the remaining three are still in first-class condition. As the pear is naturally long-lived, these trees will probably last for many years to come. Of the two apple-trees, one (of the Becker variety) is still alive and thrifty.

RESULTS OF THE EXPERIMENT.

The results of the experiment are, briefly stated, *good trees and little fruit*. The small yield was due chiefly to three causes—(1) irregular winters and late frosts, (2) high winds and hail-storms, and (3) the planting of many varieties not adapted to so southerly a climate.

Other agencies that interfered with the success of the orchard are birds, plant-lice, crown-gall, chlorosis, and pear-blight. Woodpeckers and mocking-birds damaged or destroyed much fruit, even attacking it before it was ripe. With a large orchard or more nearly simultaneous ripening of the crop the loss from this cause would have been much smaller. Aphids, or plant-lice, were very destructive to the American plums, sometimes causing the loss of the entire crop and injuring the trees besides. Fortunately they did not attack the Japanese varieties. Some of the trees became affected with chlorosis, probably due to an excess of lime in the soil. All of these cases were promptly cured by the addition of one or more pounds of copperas, dissolved in water, to the soil. Blight appeared at times on all the pear trees, except those of the Kieffer variety, but did no serious damage. Crown-gall was found on several of the peach-trees, but it had little noticeable effect on their health. Sun-scald was practically absent, except on decrepit trees. Immunity from this trouble, so common in cultivated trees, was due to low, spreading crowns, induced by a rational method of pruning.

THE MOST SUCCESSFUL VARIETIES.

The most successful varieties of plums were found to be Hale, Burbank, Gonzales, and Wickson—all Japanese varieties except Gonzales, which is a cross (Japanese and American.)

Hale makes a strong growth, thrives in shallow soil, and exceeds the other varieties in longevity. It bears regularly, but not always a full crop. The fruit, which begins to ripen toward the close of May, is medium-sized, sweet, and juicy.

Burbank is a spreading tree of awkward habit that begins to bear when very young. It often overbears, which results in the shortening of its life and the production of inferior fruit. The fruit, which ripens in June and July, is medium-sized to large, firm, and of good quality.

Gonzales begins to bear one year after planting. It bears regularly and, like Burbank, tends to overbear. Its fruit, which begins to ripen about June 1st, is medium-sized, red, of attractive appearance, and according to some, sweet and juicy. The fruit produced by the writer's trees, however, was always rather insipid.

Wickson is a slender tree that begins to ripen its fruit about July 1st. The fruit is very large and has a small stone. The flesh is yellow, firm, and sweet. This fruit is devoid of acid, but very palatable when eaten raw and excellent for canning.

Of the many varieties of peaches tested, but two, Pallas and Japan Dwarf Blood, have been productive enough to be considered successful. Unfortunately but one tree of the Pallas variety was planted. This has borne a full crop, beginning one year after planting, for every year except the two in which the destructive hail-storms occurred and one in which a heavy frost visited the orchard on March 20th. Thinning was several times necessary to prevent overbearing. The fruit of this variety, which begins to ripen about July 1st, is a freestone, small to medium-sized, white-fleshed, sweet, and juicy. By some it is much prized; others regard it as inferior because of the absence of acid. The tree is now in a decrepit condition and probably past its period of usefulness, but it has done its full duty. Pallas and other varieties of the Honey strain are apparently the best peaches for commercial planting in this section.

Japan Dwarf Blood is a stocky, dwarfish tree with a spreading crown. These characteristics tend to prevent sun-scald and the splitting and breaking of branches, and also facilitate the gathering of the crop. The fruit, which

begins to ripen about the 1st of June, is a freestone, medium-sized to large, with a red cheek and flesh marked with red, subacid, juicy, and varying from somewhat insipid to luscious. This variety bears early, often beginning one year after the planting. The writer's trees have borne nearly as regularly as his Fallas, but the crop has usually been light. The writer's trees of this variety have stood the trying conditions of the last ten years better than those of any other variety of peaches. They are still in first-class condition and give promise of producing a number of additional crops before their usefulness ends.

The varieties of pears that the writer has found to be most successful are Kieffer, LeConte, and Smith's Hybrid.

The Kieffer pear is large and well suited for cooking and canning and, when properly ripened, for eating raw. The fruit of LeConte is medium-sized, mellow, sweet, and juicy. That of Smith's Hybrid is large, mealy, subacid, somewhat juicy, and slightly acid. These varieties ripen their fruit in the late summer.

The Becker apple-tree has proved a regular bearer, in spite of irregular winters and late frosts. The fruit, which ripens in late summer, is medium-sized, yellowish with red cheek or markings, mealy, and subacid. The tree may easily be propagated by suckers growing from the roots.

CONCLUSION.

From what has preceded it will be seen that orcharding without irrigation in the San Antonio region is a somewhat precarious undertaking. It may be added that even with irrigation success is by no means assured, for the writer has seen irrigated orchards in which the trees did not last as long as in his own. Planting in deep soil, frequent but shallow cultivation, the selection of well-tested varieties only, and the use of scientific methods generally are requisites to success. The amount of rainfall during the first year or two after the planting of an orchard is an impor-

tant factor in its success or failure. When trees are once well established they can endure a good deal of drought, but lack of moisture during the first year after the planting of the trees means disaster. While a good deal of misfortune befell the writer in his experiments, he was lucky in having sufficient rainfall while the orchard was in its infancy, and in consequence not a tree was lost in the first few years. The heavy rains of the past few months seem to indicate that another such propitious period has set in. Here, then, is a favorable opportunity for those who wish to try dry-land orcharding.

On the completion of his manuscript the writer submitted it to Mr. S. H. Hastings, superintendent of the San Antonio Experiment Farm. Mr. Hastings, after perusing it, wrote the following instructive and encouraging letter:

San Antonio, Texas, Dec. 22, 1913.

Prof. Bernard Mackensen,
San Antonio, Texas.

Dear Prof. Mackensen:

I have read your manuscript regarding Dry-land Orcharding with much interest and believe by all means that it should be placed before the public.

It seems to me, however, that you have not done full justice to your method of conserving the surface runoff. As you brought out, it is absolutely necessary to plant adapted varieties or the grower will fail, no matter how favorable other conditions are. Our experiences here and from reading your paper has led me to believe that the failure with your trees was largely due to the planting of unadapted varieties together with the fact that the years 1909 to 1911 were extremely severe rather than to any fault with your method.

Some of the more hardy varieties listed in your paper have survived the 11 years that you have been growing

them in good condition and if you had only planted these varieties your orchard would have an altogether different appearance at this time. The fact that you carried as many trees as you did through the 11 years considering the relatively short life of the peach and the extremely adverse conditions which occurred during the period indicates that if the weather conditions had been approximately normal you would have carried your orchard through with surprisingly good results.

Very truly yours,

S. H. HASTINGS.



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